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HIGH TECH STUDY ADDENDUM: THE EFFECT OF HIGH TECH R&D INCENTIVES ON JOBS

Statute requires that the Department of Revenue assess the high technology tax incentive programs on their effectiveness in creating jobs. This addendum to the High Tech Study focuses on the question: Do the incentives have an effect on jobs?¹

Summary of Results

Analysis shows that one of the two incentives targeted at investment in high tech industry plant and equipment is associated with the creation of new jobs, at least within the firms that took advantage of these incentives. Over the years 1997 and 1998, a higher level of tax relief by means of the R&D sales tax exemption is associated with higher employment. Conversely, there is no statistical connection between the B&O tax credit and job creation.

¹ The statutes require an assessment of and report on these programs in the years 1997, 2000, and 2003. The Legislature directed the Department to measure the effects of each program on the following features of the state's economy:

- (1) job creation,
- (2) the number of jobs created for Washington residents,
- (3) company growth,
- (4) diversification of the state's economy,
- (5) growth in R&D investment,
- (6) introduction of new products,
- (7) movement of firms or the consolidation of firms into the state, and
- (8) other factors selected by the Department.

There are several caveats to this analysis. First, the results reflect the impact of the tax incentives at a point in time. The magnitude of these results may not be applicable to time periods outside the 1997 and 1998 period. Second, two principal models were constructed, one with the eight largest high tech participants and one without these eight firms. Both models were constructed because the eight largest high tech participants could be considered either statistical outliers or merely large firms whose employment dominates the high tech sector. A firm is a statistical outlier if it does not belong in the database, for example, because there is a keying mistake or the firm is completely different from other firms. Finally, only those firms actively engaged in business in the period before and after enactment of the incentives are included in the model. The results are specific to these 467 firms.

The results of the two models are:

1. With the eight possible outliers included in the model: For the firms that took the incentives, each \$1 million of the R&D sales tax exemption is associated with the creation of about 500 jobs.
2. With the eight possible outliers excluded from the model: For the firms that took the incentives, each \$1 million in incentives is associated with the creation of about 325 jobs.

Of the 1,400 firms that have taken the high tech incentives over the life of the program, 467 of them were actively engaged in business during the periods before and after enactment of the incentives that are covered by the analysis. The results can be extrapolated to these firms.

Profile of Firms in the Study Data Base

The table below compares study data base statistics with statistics for all participants.

Table 1
COMPARISON PROFILES OF ALL PARTICIPANTS AND STUDY FIRMS
Annual Averages for 1997-1998

	All Participants	Study Firms
Number of firms	561	467
Employment	115,659	79,018
Change in employment (1993-94 to 1997-98)	33,536	17,468
High tech sales tax exemption	\$20,953,390	\$7,891,000
High tech B&O credit	\$28,799,700	\$24,435,000

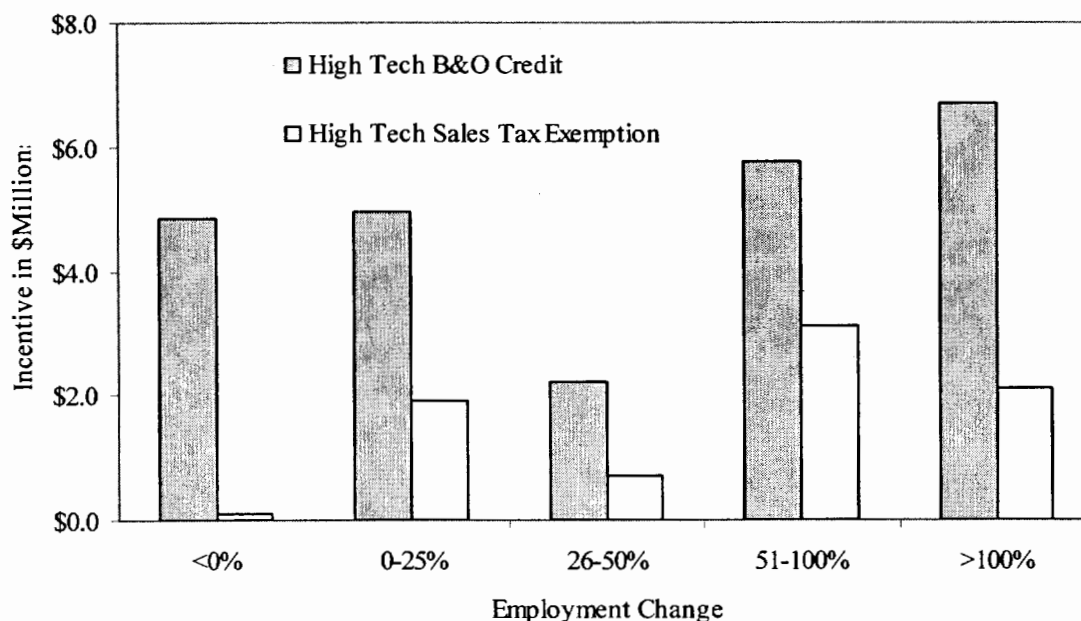
The table and chart below compare incentives taken by study firms with differing levels of employment growth. They show that employment change for the firms bears no discernible

relationship to the amount of their high tech B&O credit. Firms with higher levels of employment tend to be taking higher levels of the high tech sales tax exemption.

Table 2
CHANGE IN EMPLOYMENT COMPARED WITH AMOUNT OF INCENTIVE TAKEN
Firms Stratified by Employment Growth Rate

Percent Change in Employment	Number of Firms	High Tech B&O Credit	High Tech Sales Tax Exemption
<0%	124	\$4.9	\$0.1
0-25%	62	5.0	1.9
26-50%	39	2.2	0.7
51-100%	62	5.7	3.1
>100%	<u>180</u>	<u>6.7</u>	<u>2.1</u>
All	467	\$24.5	\$7.9

Chart 1
CHANGE IN EMPLOYMENT BETWEEN STUDY PERIODS
COMPARED TO AMOUNT OF INCENTIVE TAKEN



Study Results

The sales and use tax exemption for R&D facilities and equipment is associated with approximately 1,000 new annual jobs in 1997-98 if the eight possible outlier firms are not included. If the possible outlier firms are included, the R&D sales and use tax incentive is associated with approximately 4,000 jobs during the study period. Note that only 18 firms in the entire data set and 15 firms in the data set without possible outliers took the sales tax exemption during 1997-98.

The study showed that the B&O tax credit for high tech R&D spending had no measurable effect on the increase in jobs for the two-year period.

Table 3
SUMMARY OF RESULTS FOR STUDY FIRMS
Annual Averages for 1997-1998

	With 8 Possible Outliers	Without 8 Possible Outliers
Summary Statistics		
Total employment	79,018	50,917
Change in employment	17,468	17,129
High tech sales tax exemption	\$7,891,000	\$3,081,000
High tech B&O credit	\$24,435,000	\$19,181,000
High Tech Sales Tax Exemption--Jobs		
Number of new jobs per \$1 million associated with the high tech sales tax exemption	500	325
Number of new jobs associated with the high tech sales tax exemption	4,000	1,000
High Tech Sales Tax Exemption--Jobs in Percentages		
New jobs associated with high tech sales and use tax exemption as a percent of total employment	5%	2%
New jobs associated with exemption as a percent of change in employment	23%	6%
High Tech B&O Credit--No Jobs Associated with Credit		

Description of Methodology

In order to measure the impact of the high tech B&O tax credit and sales tax exemption incentives on employment, a statistical model was designed in the form of a natural experiment.

The experiment contained information on firms that took full advantage of at least one of the two tax programs. The control group consisted of the following types of firms: those that reached the maximum credit amount, firms that did not have enough B&O tax liability to credit against, or those that took advantage of one high tech incentive.

Note that most firms in the database took advantage of the B&O credit, but few took advantage of the R&D sales tax exemption. Other than their participation levels in the incentive programs, the firms selected were similar to each other in terms of industry and the types of economic markets they face.

The following hypotheses were tested:

1. Firms that took one of the incentives or had proportionately higher levels of incentives experienced a higher level of employment, when all other factors were equal, compared to firms that did not take the incentive or had proportionately lower levels of incentives.
2. Employment was higher for the two-year period after the incentives compared to their employment in the two-year period before the incentives, all other factors held equal.

Econometric equations are the statistical method used to measure the impact of the incentives holding all other factors equal. Such equations isolate the impact of one particular variable upon another when many variables are changing at the same time. The econometric equations measure the impact of firm participation in the incentives on employment. The firm's participation is measured by the dollar value of the tax incentive received by the firm.

Employment is alternatively measured as the number of employees or the dollar value of the firm's wage bill. Unfortunately, the data for number of employees includes full-time and part-time employees. The most desired measure, the firm's full-time equivalent (FTE) employment level, is not available.

Other factors affect employment such as the firm's gross business income and employment trends. Purchases for manufacturing machinery and equipment became exempt from retail sales tax shortly after the Legislature enacted the high tech incentives. These variables are included since they may also have an influence on employment.

Individual firms can differ from one another in subtle ways that are difficult to measure. For example, two firms of similar size and of the same industry can have different employment levels because of differences in product mix or organizational structure. We assume these differences do not change significantly over time. The econometric model holds these unobservable differences constant over time by measuring the *change* in employment levels and the *change* in other determining variables between the two periods.

The data set used for estimating the econometric equations was developed from Department of Revenue and Employment Security data for 467 individual firms.

Statistical analysis was conducted on the data that identified eight firms that are possible outliers. Since it is unclear whether the eight largest high tech participants are actually statistical outliers or merely large firms whose employment dominates the high tech sector, two versions of the model were estimated, one with and one without the possible outliers.

Model Specification

The dependent variable of the basic econometric model is the change in each firm's level of employment. Independent variables are:

1. The amount of the B&O tax credit for each firm,
2. The amount of the R&D sales tax exemption for each firm,
3. The amount of the manufacturing machinery and equipment sales tax exemption for each firm,
4. The change in the firm's gross business income, and
5. The firm's level of employment in the period before enactment of the incentive, calendar years 1993 and 1994.

The variable for the machinery and equipment exemption is estimated from sample data on actual usage extrapolated to high tech firms based on industry, manufacturing activity, and size.

Econometric Model Results

The results of the model show that the R&D sales tax exemption had a statistically significant positive association on employment. The coefficient for the sales tax exemption variable in the equation including the eight possible outliers is equal to .001 with a t-statistic of 14.69, which means that the coefficient tests positive at the 99 percent confidence level. The coefficient for the sales tax exemption variable in the equation *without* the eight possible outliers is equal to .00065 with a t-statistic of 10.43, which means that the coefficient tests positive at the 99 percent confidence level.

The coefficient for the B&O tax credit was statistically insignificant, implying that there is no connection between the B&O tax credit and job creation. The other variables have significant coefficients with signs that make sense theoretically.

The adjusted R^2 is .707 for the model with all observations and .626 for the model without the eight possible outliers.

Table 4
ECONOMETRIC RESULTS WITH ALL OBSERVATIONS

Variable	Coefficient	t-statistic
Intercept	5.09	0.27
Change in GBI	0.000003	10.91
1993-94 employment	-0.3065	-10.83
B&O tax credit	0.000129	1.51
R&D sales/use tax exemption	0.00103	14.69
M&E sales/use tax exemption	0.000506	7.08

Table 5
ECONOMETRIC RESULTS WITHOUT THE POSSIBLE OUTLIERS

Variable	Coefficient	t-statistic
Intercept	27.4986	3.58
Change in GBI	0.000002	16.39
1993-94 employment	-0.0929	-4.11
B&O tax credit	-0.000056	-1.20
R&D sales/use tax exemption	0.00065	10.43
M&E sales/use tax exemption	0.00028	4.99

Testing and Reliability of Results

The econometric models were extensively tested. Several different model specifications were estimated. Two different measures related to employment were used--total employment and total wages. In all cases, the models yield consistent results, implying reliability of the models.

One other test that was performed dealt with outliers in the data. Statistical analysis indicated that the eight largest high tech participants could be considered statistical outliers. Therefore, the econometric models were estimated with and without the eight possible outliers. In models both with and without the outliers, the overall conclusion is the same: There is a strong statistical effect of the R&D sales and use tax exemption on jobs. However, in the model with the eight firms included, the results indicate a higher association with jobs than in the model without the eight firms. It is not clear whether these firms are truly outliers or merely large firms whose employment dominates the high tech sector. Therefore, the results of this analysis are presented as a range. The high end of the range represents the model with the eight large firms included. The low end represents the model without the eight large firms.

Potential Problems and Limitations

Endogeneity

One potential problem with the results is the problem of endogeneity. Endogeneity in econometrics implies that there may be self selection. In this case, firms that choose to participate in the high tech incentives could be firms that also choose higher levels of investment and therefore higher levels of employment. This potential problem means that the results should be interpreted cautiously; that the results only imply that the impact on jobs is limited to participating firms.

The endogeneity problem does not affect the reliability of the results as they apply to participating firms. This is because among the participating firms, there are varying levels of participation in the programs.

Other Limitations

The results of the econometric analysis measure the impact of the incentives on employment at a single point in time. The magnitude of these results may not be applicable to other periods. For example, during 1997 and 1998, many high tech firms were more highly leveraged than in other periods. Therefore, investment in these firms (including investment in the form of tax relief) could yield higher growth in 1997-98 than in other periods.

Comparison with Past Studies and Possible Future Improvements

Past Studies

The natural experiment econometric model is a new approach for measuring the effectiveness of Washington State tax incentives. Previous studies, including the 2000 High Tech Study done by the Department of Revenue and the analyses of the sales tax exemption for manufacturing machinery and equipment done by the House Finance Committee, used a macroeconomic approach to answering the effectiveness question. These studies compared total Washington employment for the affected industries with U.S. employment for the same industries. This type of analysis is best suited to indicate very large impacts. The results of each of these studies were inconclusive. The microeconomic experiment approach, as utilized here, is better able to measure more subtle impacts and, therefore, yields more conclusive results.

Future Improvements

The problem of endogeneity could possibly be addressed by including in the data firms in non-high-tech industries that did not participate in any of the incentive programs.

Another improvement would be to estimate a two-stage model where the first stage is the impact of the incentives on the investment decision and the second stage is the impact of investment on

job creation. Such a model could give a more definitive estimate of the causality between the incentives and employment. In order to estimate this type of model, data on investment levels both before and after participation and for participants and nonparticipants are necessary. Unfortunately, such data do not exist currently.